REMARKS

Claims 4, 11 and 20 have been rewritten in independent form, to overcome the outstanding Section 112 rejection. Withdrawal is requested.

Claims 1, 2, 4-9, 11-13, 8 and 20 stand rejected under Section 103 on the basis of Veerasamy, U.S. '477, Veerasamy et al., U.S. '225 and JP '836. Applicants respectfully traverse this rejection because there is no motivation or suggestion to combine or modify the cited references.

As the Examiner mentioned on page 3, lines 1 to 3 of the Office Action, U.S. '477 do not disclose a carbon layer in which a nitrogen concentration is distributed in an inclined concentration gradually increasing from a bottom surface side to a top surface side. This is because, as is disclosed in column 8, lines 1 to 22 of U.S. '477, the selective incorporation of nitrogen is only intended to widely vary the electrical conductivity of the carbon layer. Further, since the nitrogen is introduced by doping, a problem arises because the carbon layer contains nitrogen in only a surface portion of the carbon layer.

U.S. '225 also does not teach that a nitrogen concentration is gradually increased from a bottom surface side in the carbonaceous protective layer. This is because in U.S. '225, a layer of diamond-like carbon (DLC) is doped with a dopant (nitrogen). This means that nitrogen is selectively doped in an upper portion of the DLC layer. Apparently, no gradual increase in the nitrogen concentration from the substrate is obtained in the resulting nitrogen-doped DLC layer of U.S. '225.

According to U.S. '225, adhesion of a lubricant layer to the DLC layer will be improved as a result of nitrogen doping. However, due to selective doping of the nitrogen in the upper portion of the DLC layer, hardness of the DLC layer is reduced because a large amount of the nitrogen is doped into the DLC layer. Contrary to U.S. '225, according to the present invention, good adhesion of the lubricant layer to the carbonaceous protective layer can be obtained while inhibiting a reduction of the layer hardness in the carbonaceous layer as a result of the controlled addition of nitrogen, as is disclosed in, for example, page 6, lines 27 to page 7, line 8, of the specification.

Referring to JP '836, the Examiner mentioned that nitrogen may be contained in a carbon layer in a concentration gradient in the thickness direction of the carbon layer with the layer concentration highest at the surface. Applicants agree with this observation, but believe that JP '836 does not provide any motivation for accomplishing the present invention. For one thing, the present invention is directed to formation of the carbon layer using the Filtered Cathodic Arc process, while JP '836 is directed to formation of the carbon layer using a sputtering process, as is disclosed in, for example, paragraphs 0013 to 0015 of JP '836.

As described on page 3, lines 2 to 34 of the present specification, according to JP '836, sufficiently high durability cannot be obtained when the carbon layer is produced at a reduced thickness or 5 nm or less, because the layer formation is based on sputtering. Contrary to this, according to the present invention, high durability can be unexpectedly obtained even when the layer thickness is 5 nm or less, as disclosed in page 6, lines 13 to 16 of the present specification.

According to the invention of claims 4, 11 and 20, additional effects can be obtained in addition to the above-described effects resulted in the invention of claims 1, 8 and 18. For example, as is disclosed on page 18, lines 4 to 15 of the text, adhesion between the carbon layer and the lubricant layer and the layer hardness of the carbon layer can be simultaneously amplified as a result of the two-layered carbon layer recited in claims 4, 11 and 20. Withdrawal of this rejection is respectfully requested.

For the foregoing reasons, Applicants believe that this case is in condition for allowance, which is respectfully requested. The examiner should call Applicants' attorney if an interview would expedite prosecution.

Respectfully submitted,

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